MEMORANDUM

To: Bulletin 160 Advisory Committee and DWR Staff

From: Spreck Rosekrans and Ann Hayden

Date: November 6, 2003

Subject: Quantification of Unmet Environmental Objectives in State Water Plan 2003

As requested, we are submitting the following information based on our recent preliminary analysis of existing unmet environmental flow objectives. The issues we raise now are similar to those presented in earlier letters to DWR, including a letter signed by ten organizations represented on the Advisory Committee.[1] Past bulletins have not adequately addressed unmet environmental water objectives and we believe that this plan should include a quantified summary of such unmet objectives. This analysis is a starting point to what ideally will become a more comprehensive assessment in the near future.

Presently, the State Water Plan is expected to consider four scenarios of plausible futures for a range of uncertainties, including Current Trends, High Efficiency, Resource Intensive, and Future Food Production (as to AB 2587). Within these scenarios, two levels (current trends and high) of environmental water use are identified. In the case of "current trends", environmental objectives are categorized as "current water dedication", an assumption that will likely result in modeling indicating that environmental objectives are being met. In fact, numerous environmental flow objectives exist that continue to go unmet, such as federal and State legal mandates to double salmon populations. Of the four scenarios, it appears that only the High Efficiency/Pie in the Sky Scenario would potentially meet all environmental flow objectives. Whether these objectives are adequately met under these alternative scenarios is a matter for staff and AC consideration, but we hope that providing a quantified summary of such objectives will shed some light on what is actually occurring.

At the core of many of these environmental flow objectives is the goal of re-creating the natural hydrograph in systems impaired by water storage projects. By establishing appropriate flows, riverine ecosystems processes can be maintained, such as channel and riparian vegetation corridor maintenance, and ultimately the maintenance of aquatic species populations.

To more accurately address the current unmet environmental water objectives, we believe that these following objectives should be quantified to identify where gaps exist:

[1] "Proposed Demand Levels" for evaluation in the 2003 California Water Plan", July 18, 2002.

- Trinity River flows consistent with Trinity River Mainstem Restoration Plan ROD (fall 2000).
- Additional water required meeting the flow objectives in the "Final Restoration Plan for the Anadromous Fish Restoration Program" (2001).
- A level of protection in the Bay-Delta that is equivalent to that specified by CALFED ROD, and required for long-term ESA assurances. This includes a viable Environmental Water Account, the Interior decision for CVPIA B2 water that allows crediting within metrics (i.e. pre offset-reset ruling) and a fully functional Tier 3.
- San Joaquin flows needed to comply with the federal court order to restore the salmon fishery below Friant Dam.
- All Level 4 Refuge Supplies.
- The Ecosystem Restoration Program purchases identified in the CALFED ROD for Stage One implementation to be used to meet the flow objectives outlined in the CALFED Final EIR/EIS (July 2000).
- Klamath River flows needed to comply with ESA requirements.
- San Joaquin River flows at Vernalis consistent with levels specified in the 1995 Water Quality Control Plan.

A preliminary assessment of quantified unmet environmental objectives under the "current trends" scenario for some of these locations is provided in a summary table and discussion below. There is considerable variability in the extent to which there is conflict between meeting these objectives and meeting water delivery objectives for the urban and agricultural sectors.

Summary

Our analysis suggests the following quantities for the selected unmet objectives. Note that in some cases, there would be an effect on consumptive use and in other cases no effect. For example, American River flows might be recaptured in the Delta, which Trinity River flows would not be recaptured.

Environmental Water Objective	**Unmet Quantity (TAF)**
Trinity	164
AFRP (American)	199

AFRP (Stanislaus)	70
B2	331
EWA	152
San Joaquin River	349
Level 4 Refuges	125
ERP Target 1 (Delta Outflow)	63
ERP Target 2 (Delta Outflow)	122
ERP Target 4 (Freeport)	17
Total	**1,592-1,688**

Trinity River

Existing Trinity River flows are projected in CALSIM studies[2] performed as part of the preliminary draft of the CVP OCAP, and include 369 TAF/year in critical years and 454 TAF/year in all other years. Objectives for the Trinity River are in the Trinity River ROD. Since the year types for the Trinity Basin, as defined in the ROD, are available only since 1953, our analysis only incorporates the hydrology between 1953 and 1994. This analysis projects an annual average deficiency of environmental flows of **164 TAF**. (See attached spreadsheet for summaries by year type)

American River

Existing American River flows are projected by the same CALSIM studies and incorporate the hydrology between 1922-1994. Objectives for the American River are outlined in the Anadromous Fish Restoration Program[3]. This analysis projects an annual average deficiency of environmental flows of **199 TAF**. (See attached spreadsheet for summaries by year type)

Stanislaus River

Existing Stanislaus River flows are projected by the same CALSIM studies. Objectives for the Stanislaus River are outlined in the AFRP. This analysis incorporates the hydrology between 1922-1994. This analysis projects an annual average deficiency of environmental flows of **70 TAF**. (See attached spreadsheet for summaries by year type)

CALFED In-Delta Baseline (EWA and B2)

The B2 Account and EWA are environmental obligations prescribed in the CVPIA and CALFED ROD, respectively, to provide benefits to fisheries and aquatic habitat in the Central Valley and Bay-Delta. In terms of B2, Interior's most recent 2003 policy for managing B2 supplies has significantly diminished the amount of water available for

[2] 2003\Modeling\Today\BSTCH_2001D10A_BASE_031003\JPOD\DSS\2001D10ADV.DSS
[3] Final Program for the Anadromous Fish Restoration Program, 2001

protection and restoration. While the amount of water lost is expected to vary from year to year, in 2002, the single year in which Interior's revised policy has essentially been in effect, the approximate amount of deficient flows is **331 TAF** (this amount was charged to the B2 account that would not have been charged under the 1999 policy)[4].

As for the EWA, while protective operations have had some positive effects on aquatic habitat and the health of the Delta's fisheries, gaps in this account still exist. The CALFED ROD specifies that an annual average of 195,000 acre-feet should be made available through operational flexibility[5]. Since its inception almost three years ago, an average of only 43,000 acre-feet has been acquired for the EWA through operational flexibility, leaving a gap of **152 TAF.**

San Joaquin River

San Joaquin River flow objectives are based on a URS Report[6], completed as part of the settlement process between NRDC and the Friant Water Users Authority. Currently, 117 TAF flow are annually released down the San Joaquin River to satisfy downstream prior-right riparian water user and contract objectives.

The environmental flow objectives for the San Joaquin River are provided in the water quality study and project an annual average deficiency of **349-445 TAF.**

Level 4 Refuges

As prescribed in the CVPIA, Level 4 Refuge Water is the water needed in addition to current average annual water deliveries (Level 2 Refuge Water) to 19 Sacramento and San Joaquin refuges[7]. Incremental Level 4 water is based on 10% increments of water to be delivered to the refuges until year 10 (2002) when it was expected the full amount would be attained. To date, this amount has not been largely due to funding limitations and the growing cost of water (e.g.: average cost of water has increased from $50-60/af in 1995 to $125-$150/af in just eight years). Moreover, necessary construction of refuge conveyance systems has not occurred at a number of refuges, further limiting the supply of water to the refuges. In all, the unmet environmental water needs at Level 4 Refuges totals **125 TAF.**

Ecosystem Restoration Program

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[4] DWR's draft CALSIM study ("Summary of CALSIM Model Studies at 2001 Level of Development to Compare Pre-Wanger and Post-Wanger Simulated Operations," October, 2002) indicated an average difference of 166,000 acre-feet resulting from the change in Policy. CALSIM's limitations, however, as a monthly model, include an inability to capture the significant effects of the stringent one-way daily accounting under Interior's 2003 policy.

[5] CALFED ROD page 58. Operational flexibility measures include SWP pumping of B2/ERP upstream releases, use of joint point, export/inflow ratio flexibility, and 500 cfs SWP pumping increase.

[6] "Water Supply Study: Development of Water Supply Alternatives for Use in Habitat Restoration for the San Joaquin River", URS, 2003.

[7] Summary of Refuge Needs, Dale Garrison, USFWS, 2003.

The CALFED Ecosystem Restoration Program focuses on the connection between meeting the flow needs on the Sacramento, Feather, Yuba, American, Mokelumne, Tuolumne, and Merced Rivers and the freshwater inflow needs in the Delta. The ERP includes three quantifiable flow objectives for each year type, including Target 1: March outflow, Target 2: late-April to early May outflow, and Target 4: May flows on the Sacramento River[8]. For the purposes of this analysis, for Target 2, we assumed the ERP pulse flow would occur in the wetter period, which typically was in April. For all the targets, the target flows had to occur for ten days and we assumed flat flows across the month. Existing flows for each of these targets are projected by CALSIM studies and incorporate the hydrology between 1922-1994. This analysis projects an annual average deficiency of environmental flows of 63 TAF for Target 1, 122 TAF for Target 2, and 17 TAF for Target 4, for a total of **202 TAF**.

While the above preliminary analysis provides much needed information on unmet needs, there are still many other environmental water objectives that need to be quantified. A truly comprehensive analysis would include environmental water legal mandates that occur statewide, extending from the Klamath River in the north to the Salton Sea in the south. Even in the Bay-Delta, more quantification is necessary, such as San Joaquin River flows at Vernalis to ensure compliance with Water Quality Control Plan requirements. Unfortunately, while data exists to analyze some of these objectives, there are significant gaps in data collection throughout the state--a fact that requires serious attention and action from relevant agencies.

Trinity River: Unmet flow objectives under current policy (TAF)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
All Years	0	0	0	0	0	0	0	61	76	26	0	0	**164**
Extremely Wet	0	0	0	0	0	0	0	79	187	30	0	0	**297**

[8] "Volume II: Ecosystem Restoration Program Plan, Sacramento-San Joaquin Delta Ecological Management Zone Vision," July 2000.

Wet	0	0	0	0	0	0	0	104	103	41	0	0	**249**
Normal	0	0	0	0	0	0	0	78	79	44	0	0	**202**
Dry	0	0	0	0	0	0	0	0	0	1	0	0	**2**
Critically Dry	0	0	0	0	0	0	0	0	0	1	0	0	**2**

American River: Unmet flow objectives under current policy (TAF)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
All Years	37	30	15	13	9	26	23	21	14	0	8	3	**199**
Wet	70	40	11	3	1	48	36	34	26	0	11	2	**281**
Above Normal	37	40	24	4	0	0	2	9	2	0	3	0	**122**
Below Normal	31	27	23	19	5	21	30	18	17	0	17	11	**219**
Dry	24	26	16	25	17	12	8	3	8	0	1	0	**140**
Critical	6	12	4	17	24	31	28	37	9	2	5	2	**175**

Stanislaus River: Unmet flow objectives under current policy (TAF)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
All Years	1	4	4	5	4	5	16	14	16	0	0	1	**70**
Wet	1	5	4	5	4	2	6	5	27	0	0	0	**60**
Above Normal	1	4	4	4	3	3	13	11	23	0	0	1	**69**
Below Normal	1	5	5	8	4	7	26	22	22	1	1	2	**103**
Dry	1	3	3	7	5	9	27	22	3	0	0	1	**81**
Critical	1	1	2	3	3	5	19	18	0	0	0	0	**52**

ERP Target 1 (Delta Outflow): Unmet flow objectives under current policy (TAF)

	Mar
All Years	**63**
Wet	0
Above Normal	52

Below Normal	174
Dry	104
Critical	5

ERP Target 2 (Delta Outflow): Unmet flow objectives under current policy (TAF)

	Apr	May	Ann
All Years	76	46	**122**
Wet	0	0	0
Above Normal	186	146	332
Below Normal	124	93	217
Dry	133	20	153
Critical	0	0	0

ERP Target 4 (Freeport): Unmet flow objectives under current policy (TAF)

	May
All Years	**17**
Wet	9
Above Normal	0
Below Normal	17
Dry	50
Critical	0

Format of Attached Spreadsheet

Trinity River (unique year type starting in 1953)

Row 5-9: Trinity ROD flow targets

Row 53-94: Flow needs applied to annual historical hydrology

Row 122-194: Existing flows from OCAP (CALSIM model)
(run: BSTCH_2001D10A_BASE_031003\JPOD\DSS\2001D10ADV.DSS)

Row 216-220: Year type summary (year type is an index for flow objectives)

Row 253-294: Calculated monthly unmet flow objectives (Flow needs by historical hydrology – Existing flows = Unmet flow objectives)

American River (40-30-30 year type)

Row 15-20: Monthly flow targets (as stated in the AFRP)

Row 22-94: Flow needs applied to annual historical hydrology

Row 122-194: Existing flows from OCAP (CALSIM model)
(run: BSTCH_2001D10A_BASE_031003\JPOD\DSS\2001D10ADV.DSS)

Row 214-218: Year type summary (year type is an index for flow objectives)

Row 222-294: Calculated monthly unmet flow objectives (Flow needs by historical hydrology – Existing flows = Unmet flow objectives)

Stanislaus River (60-20-20 year type)

Row 5-9: Monthly flow targets (as stated in the AFRP)

Row 22-94: Flow needs applied to annual historical hydrology

Row 122-194: Existing flows from OCAP (CALSIM model)
(run: BSTCH_2001D10A_BASE_031003\JPOD\DSS\2001D10ADV.DSS)

Row 214-218: Year type summary (year type is an index for flow objectives)

Row 222-294: Calculated monthly unmet flow objectives (Flow objectives by historical hydrology – Existing flows = Unmet flow objectives)

ERP Flow Targets:

Target 1 (40-30-30 year type) :
Row 14-19: Monthly flow objective (as stated in the ERP)

Row 22-94: Flow objective by year type

Row 122-194: Existing flows from OCAP (CALSIM model)
(run: BSTCH_2001D10A_BASE_031003\JPOD\DSS\2001D10ADV.DSS)

Row 214-220: Year type summary

Row 222-294: Calculated monthly unmet flow objectives (Flow objectives by historical hydrology – Existing flows = Unmet flow objectives)

Target 2 (60-20-20 year type):
Row 5-9: Monthly flow objective (as stated in the ERP)

Row 22-94: Flow objective by year type

Row 122-194: Existing flows from OCAP (CALSIM model)
(run: BSTCH_2001D10A_BASE_031003\JPOD\DSS\2001D10ADV.DSS)

Row 214-220: Year type summary

Row 222-294: Calculated monthly unmet flow objectives. This was done for both April and May by making the calculation: Flow objectives by historical hydrology – Existing flows = Unmet flow objectives. Given the challenge of determining exactly when the ERP pulse flow would occur over the two months, the assumption was made that the pulse flow occurred in the wetter period of April or May (typically April).

Target 4 (40-30-30 year type):
Row 14-19: Monthly flow objective (as stated in the ERP)

Row 22-94: Flow objective by year type

Row 122-194: Existing flows from OCAP (CALSIM model)
(run: BSTCH_2001D10A_BASE_031003\JPOD\DSS\2001D10ADV.DSS)

Row 214-220: Year type summary

Row 222-294: Calculated monthly unmet flow objectives (Flow objectives by historical hydrology – Existing flows = Unmet flow objectives)